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FIXING ELEMENT

Inventors; and
Inventors/Applicants (for US only):

Viktor Zoubek [CZ/CZ]
Na Vysine 7
46601 Jablonek nad Nison (CZ)

Vaclav Sasek [CZ/CZ]
Melantrichova 6/208
46006 Liberec (CZ)

Applicant (for all designated states except US): A. Raymond & Cie [FR/FR]
113, Cours Berriat
1-38028 Grenoble (FR)

Agent: Joachim Rüttgers
A. Raymond GmbH & Co. KG
Teichstrasse 57
79539 Lörrach (DE)

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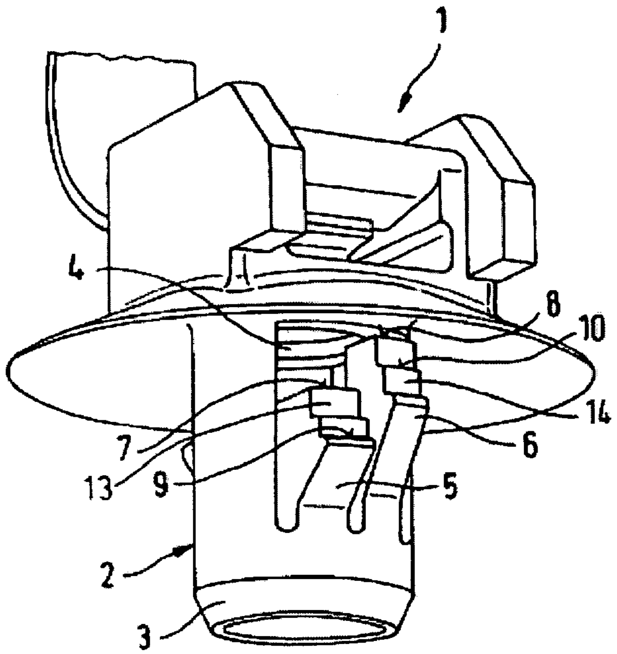

(57) Abstract: The invention relates to a fixing element for fixing a component to a support part. Said element comprises a retaining part (1) for the component to be fixed and a hollow anchor foot (2), which is used to anchor the fixing element in a continuous bore of the support part. Two sprung arm pairs (5, 6), which widen towards the retaining part (1), run from the lower edge in opposing openings (4) in the wall of the anchor foot (2), one short and one long sprung arm (5 and 6) respectively lying adjacent to one another in one of the openings (4) and being offset in relation to the short and long sprung arm (5 and 6) in the other opening (4). As both sprung arm pairs (5, 6) are graduated towards the retaining part (1), starting from a respective outer edge (11, 12) that lies at the greatest radial distance from the central axis (M) of the fixing element, front faces (7, 8) and step faces (9, 10) are created on different horizontal planes. Said faces can rest on the underside of a support part. Vertical bearing faces are created simultaneously (13, 14) at different radial distances from the central axis (M). Said vertical faces can rest on the peripheral face of bores of varying diameters. The fixing element can thus be used both for a wide range of material strengths of the support part and for a wide range of diameters of the bore with high functional reliability. Both ranges can be covered by small graduation increments. An umbrella-shaped, sprung stop (15) lying between the retaining part (1) and the anchor foot (2) permits a continuous adaptation between the stages for the range of material strengths.

The invention pertains to a fixing element for fixing a component on a support part, wherein said fixing element comprises a retaining part for the component to be fixed, a hollow anchor foot for anchoring the fixing element in a continuous bore of the support part, and a sprung stop that is arranged between the retaining part and the anchor foot, wherein the wall of the anchor foot contains two opposite openings, wherein two sprung arms that are spread apart in the direction of the retaining part respectively originate at the lower edges of said openings, wherein the ends of the sprung arms have faces that adjoin the underside of the fixing element after it is inserted into the bore of a support part, and wherein the faces of two diagonally opposing sprung arm pairs lie in two different horizontal planes.

Fixing elements of this type are generally known, but are primarily suitable for being fixed in a bore of the support part that has a certain diameter and for a certain material thickness of the support part. This means that specially adapted fixing elements must be respectively manufactured for bores with different diameters and for support parts with different material thicknesses.

DE 201 01 328 U1 discloses a fixing element in which tolerance compensation between the fixing points can be achieved when mounting one planar body on another with the aid of several such fixing elements. This is achieved by realizing the fixing element in two parts and by

allowing a certain mobility of the anchor foot in the retaining part perpendicular to the center axis. The anchor foot is prevented from turning in the retaining part by lateral projections on the shaft. Although not required, the outside surfaces of the sprung arms may be divided into two sections by a shoulder such that one planar body can assume an intermediate or pre-assembly position relative to other planar body during the installation, wherein the connection is still loose and one body can still be laterally moved in the aforementioned intermediate or pre-assembly position. This is realized by making the diameter defined by the outside surfaces of the sprung arms smaller behind the aforementioned shoulder than the diameter of the bore in the body, into which the anchor foot is inserted. The actual fixing of the component takes place in a second step, when a shoulder on the free end of the sprung arms engages behind the edge of the bore.

DE 2 153 062 A1 discloses a fixing element in which the free ends of the spread-apart sprung arms are concavely bent at the location at which they should come in contact with the edge of the bore in the support part. This allegedly serves to anchor the same fixing element in bores with diameters that vary over a certain range. However, a secure and rigid anchoring cannot be achieved with the curved contact surface of the sprung arms; another reason for this is that this publication does not aim to realize anchoring in bores with different diameters of a certain size, but rather with diameters that vary over a certain range. Pairs of laterally and perpendicularly extending projections on the shaft are only able to prevent a horizontal displacement of the anchor foot in a bore with a certain diameter, i.e., in a bore of only one size. The fixing element could not even be installed in a bore with a smaller diameter, and the installation in a bore of larger diameter could lead to the sprung arms disengaging due to the lateral play of the anchor foot.

US 2,424,757 discloses a fixing element for fixing a cylindrical component on a plate-shaped support part. The fixing element consists of a sleeve that is pushed onto the cylindrical component and from which a pair of spread-apart sprung arms protrudes laterally. The free ends of these sprung arms contain several steps. This is intended to allow the anchoring in support parts with different thicknesses. The risk that the sprung arms will disengage is also not eliminated in this case such that the component practically cannot be securely fixed in the bore of a support part.

DE 43 07 434 A1 and corresponding publication EP 0 615 071 B1 respectively disclose a holding element that contains an anchor foot in the form of a base body of rectangular cross section. All four lateral surfaces of this base body are provided with snap-in tabs that respectively lie diagonally opposite one another and can be snapped into recesses in the lateral surfaces of the base body. Two opposing snap-in tabs are realized in T-shaped form and have faces that point to the retaining part on the T-crosspieces. This allegedly results in a centering

cage effect and consequently a secure retention in the bore of a support part, even if the retaining part turns about its longitudinal axis in the bore. The faces of the snap-in tabs provided may all lie in the same horizontal plane. Alternatively, pairs of snap-in tabs may also lie in different horizontal planes such that the retaining part can be utilized on support parts of different thicknesses.

DE-GM 81 13 637 discloses a holding element that, in theory, also allows the utilization on support parts with different material thicknesses. According to one of the embodiments described in this publication, two pairs of elastic tabs that are directed toward the retaining part are provided on a base body that forms the anchor foot of round cross section, wherein the faces of said elastic tab pairs may also lie in different horizontal planes pair-by-pair. In this case, the first elastic tabs of both elastic tab pairs lie directly adjacent to one another on the circumference of the base body analogous to the other elastic tabs of the elastic tab pairs, i.e., in such a way that the elastic tabs of the shorter elastic pair lie directly opposite of the elastic tabs of the longer elastic pair, i.e., the respective elastic tabs are diagonally offset relative to one another. This is intended to allow a secure retention here in support parts with, specifically, two different material thicknesses. In order to utilize the holding element on support parts with more than two material thicknesses, additional elastic tab pairs with faces may be provided on the circumference of the base body in correspondingly different horizontal planes.

Known holding or fixing elements are designed for use in bores with different diameters in support parts or on support parts of different thicknesses or material thicknesses, the design of these holding or fixing elements is often relatively complicated and their manufacture is correspondingly costly. Nonetheless, a secure and rigid connection still cannot be ensured in all cases.

The invention is based on the objective of developing a fixing element of the initially mentioned type, in which the anchor foot is realized in such a way that it can be used on support parts with bores of different diameters as well as on support parts with different material thicknesses, while still ensuring a secure and rigid anchoring and, in particular, preventing the sprung arms from disengaging when the fixing element is laterally loaded. The new fixing element should not only be suitable for use in bores with certain different diameters and on support parts with certain different thicknesses, but rather over an at least approximately continuous diameter range and an at least approximately continuous material thickness range.

According to the invention, this objective is realized in that the short sprung arms as well as the long sprung arms radially widen in the direction of the retaining part, namely from the lower edge of the respective opening to an outer edge of the short sprung arms and an outer edge of the long sprung arms, and are then radially recessed up to their respective face in the form of

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several steps such that several horizontal step surfaces are formed in different planes and several vertical contact surfaces are formed at different radial distances from the center axis M of the fixing element on each sprung arm, wherein the faces or the individual horizontal step surfaces of one sprung arm pair lie in the same respective planes and its individual vertical contact surfaces lie at the same respective radial distances from the center axis M, but in different planes and at different radial distances from the center axis M relative to the other sprung arm pair.

This makes it possible to utilize a single fixing element for different hole or bore diameters in the support part and for different material thicknesses of the support part. A broad range of different bore diameters and material thicknesses can be respectively covered in very small increments due to the faces or step surfaces that lie in offset horizontal planes and the vertical contact surfaces that lie at offset radial distances from the center axis M.

It is advantageous that the longest radial distance between an outer edge of one sprung arm and the center axis of the fixing element is longer than half the diameter of the largest bore in the support part by such an amount that the anchor foot cannot be disengaged if the fixing element is laterally loaded, and that the shortest possible radial distance between the root of the sprung arms and the center axis is slightly shorter than half the diameter of the smallest bore in the support part. This also makes it possible easily to insert the anchor foot of the fixing element into the smallest bore provided.

The steps on the short sprung arms and the steps on the long sprung arms are preferably offset relative to one another in such a way that the faces or horizontal step surfaces of the long sprung arms and the faces or horizontal step surfaces of the short sprung arms are alternately brought into contact with the underside of the support part as the material thickness of the support part increases and the vertical contact surfaces of the short sprung arms and the vertical contact surfaces of the long sprung arms accordingly are alternately brought into contact with the circumferential surface of a bore as the bore diameter increases. The diametral range of the bores and the material thickness range of the support part can be covered in particularly small increments due to these horizontal faces or step surfaces and vertical contact surfaces that are alternately offset on the two sprung arm pairs. With respect to the material thickness range, the adaptation between the increments is realized continuously because the stop elastically comes into contact with the upper side of the support part.

The invention is described in greater detail below by way of an example with reference to the enclosed drawing; it shows:

Figure 1, a perspective representation of an embodiment of the fixing element according to the invention;

Figure 2, a side view of the fixing element according to Figure 1 in connection with the covered material thickness range F;

Figure 3, the side view according to Figure 2 in connection with the covered bore diameter range;

Figure 4, a side view of the fixing element that is turned by 90° relative to Figure 3, namely in connection with the covered bore diameter range, and

Figure 5, a scaled-down cross section through the anchor foot above the shorter sprung arm pair in Figure 4.

Figures 1-3 show different views of a fixing element with a retaining part 1 for the component to be fixed on the preferably plate-shaped support part that is not illustrated in the figures, e.g., a mounting plate, and an anchor foot 2 that is rigidly connected to the retaining part 1 and serves for rigidly anchoring the fixing element in a continuous bore of the support part. The present invention essentially pertains to the design of this anchor foot 2. The anchor foot 2 has the form of a hollow cylinder, the wall of which conventionally is slightly beveled 3 on its free end in order to simplify the insertion of the anchor foot 2 into the bore of the support part. The cylindrical wall of the anchor foot 2 is provided with two opposing openings 4 that extend as far as the retaining part 1. Two sprung arms 5, 6 lie adjacent to one another and protrude from the lower edge of each opening 4, wherein said sprung arms are spread apart in pairs in the direction of the retaining part 1. The sprung arm pair 5 is shorter than the sprung arm pair 6. The arrangement is chosen such that the shorter sprung arm 5 on one opening 4 lies directly opposite the longer sprung arm 6 on the other opening 4 and vice versa (in this respect, see also Figure 5). Thus, the sprung arm pairs 5 and 6 have faces 7 and 8 that lie in different horizontal planes. When the anchor foot 2 is inserted into a bore provided in the support part for this purpose, the faces 7 or 8 of one or the other sprung arm pair 5, 6 come in contact with the underside of the support part as a function of the material thickness of the support part. In order to allow the anchoring of the fixing part according to the invention in support parts with more than two given material thicknesses and to make it possible to cover an entire range of material thicknesses, the sprung arms 5, 6 contain several (in the embodiment shown, two) steps from their respective face 7, 8 to their respective outer edge 11, 12. These steps respectively comprise horizontal step surfaces 9, 10 (in this respect, see also Figure 2) that are directed toward the retaining part. The step surfaces 9, 10 of one sprung arm pair 5, 6 lie in the same planes respectively, but in different planes relative to the other sprung arm pair 6, 5. In the embodiment shown, the faces 7, 8 and the step surfaces 9, 10 of the sprung arm pairs 5, 6 consequently form contact surfaces for the underside of a support part in six different planes in small increments. A broad range of material thicknesses of the support part can thereby be covered in very small increments. A continuous

adaptation to the values of the material thickness is achieved between the increments due to the effect of the umbrella-shaped stop 15 that is arranged between the retaining part 1 and the anchor foot 2 and comes in elastic contact with the upper side of the support part. In one specific instance, this was realized for a material thickness range between F1 = 0.6 mm and F2 = 3.0 mm (see Figure 2).

As mentioned above, the sprung arms 5, 6 are spread apart in the direction of the retaining part 1, as far as the outer edge 11, 12 of the respectively lowest step surface 9, 10 that defines the longest radial distance R1 from the center axis M of the fixing element (see Figures 3 and 4). In addition to the horizontal step surfaces 9, 10, the steps on the sprung arms 5, 6 also comprise vertical contact surfaces 13, 14, the radial distance of which decreases from the center axis M on the ensuing steps that ascend in this direction. When the fixing element is inserted, the vertical contact surfaces 13, 14 come in contact with the circumferential surface of the bore. If the bore has a small diameter, the sprung arms 5, 6 move into the anchor foot 2 through the openings 4 until the appropriate contact surface is reached. This offset arrangement of the short and long sprung arms 5, 6 also makes it possible for these sprung arms to carry out such a movement without impairing one another during the insertion into a narrow bore. The sprung arms 5, 6 are able to cover a broad bore diameter range due to the different radial distances of the contact surfaces from the center axis M; the shortest radial distance R2 possible corresponds to the diameter of the anchor foot 2 (see Figure 4). In one specific example, this was realized for a bore diameter range between D1 = 6.2 mm and D2 = 7.2 mm.

The longest radial distance R1 from the center axis M, i.e., that of the outer edges 11, 12 of the sprung arms 5, 6, is chosen such that 2 x R1 is greater than the largest bore diameter D1 in order to prevent the anchor foot 2 from disengaging when the fixing element is laterally loaded. The shortest radial distance R2, i.e., the diameter of the anchor foot 2, is such that 2 x R2 is slightly smaller than the smallest bore diameter D2 so that the fixing element can be mounted without problem.

The described fixing element consequently can be utilized in a functionally reliable fashion over a broad bore diameter range and over a broad material thickness range of the support part. If the steps on the sprung arms 5, 6 are offset in such a way that the step surfaces 9, 10 of both sprung arm pairs 5, 6 alternately come in contact with the underside of support parts of different material thicknesses and the contact surfaces 13, 14 of both sprung arm pairs 5, 6 alternately come in contact with the circumferential surface of bores with different diameters, both ranges can be covered almost continuously in very small increments. With respect to the range of material thicknesses, a continuous adaptation between the increments is achieved with